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STATE OF MONTANA

DEPARTMENT OF STATE LANDS

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JAN 20 '77
STATE DOCUMENTS

September 20, 1976

Attached is a Preliminary Environmental Review (P.E.R.) for the proposed Hard Rock Operating Permit to the Anaconda Company, Butte, Montana. The applicant wishes to expand the tailings pond, leach dumps, waste dumps and buffer zone associated with its Berkeley Pit Complex in Silver Bow County, adjacent to and including parts of the City of Butte. Contents of this P.E.R. are those required by the Montana Environmental Policy Act (Chapter 65, Title 69, R.C.M. 1947) and the Department's rules adopted pursuant to it (Title 26, Chapter 2, Subchapter 8 of M.A.C.).

All materials submitted to the Department by the Anaconda Company as part of its application for an operating permit pursuant to the requirements of the Hard Rock Law (Title 50, chapter 12, R.C.M. 1947) are on file and available for public review in the Department's offices.

This review indicates that the issuance of the permit to the Anaconda Company does not constitute an action which might significantly affect the quality of the human environment and therefore a draft Environmental Impact Statement will not be prepared.

Sincerely,

JoAnn E. Vorozilchak

JoAnn E. Vorozilchak
Assistant Environmental Coordinator
Department of State Lands

JV/lw

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PRELIMINARY ENVIRONMENTAL REVIEW

FOR A

PROPOSED EXPANSION OF ANACONDA COMPANY'S

BERKELEY MINING COMPLEX

MONTANA DEPARTMENT OF STATE LANDS

HELENA, MONTANA

SEPTEMBER 20, 1976

SUBMITTED PURSUANT TO
MONTANA ENVIRONMENTAL POLICY ACT
SECTION 69-6504(b)(3)

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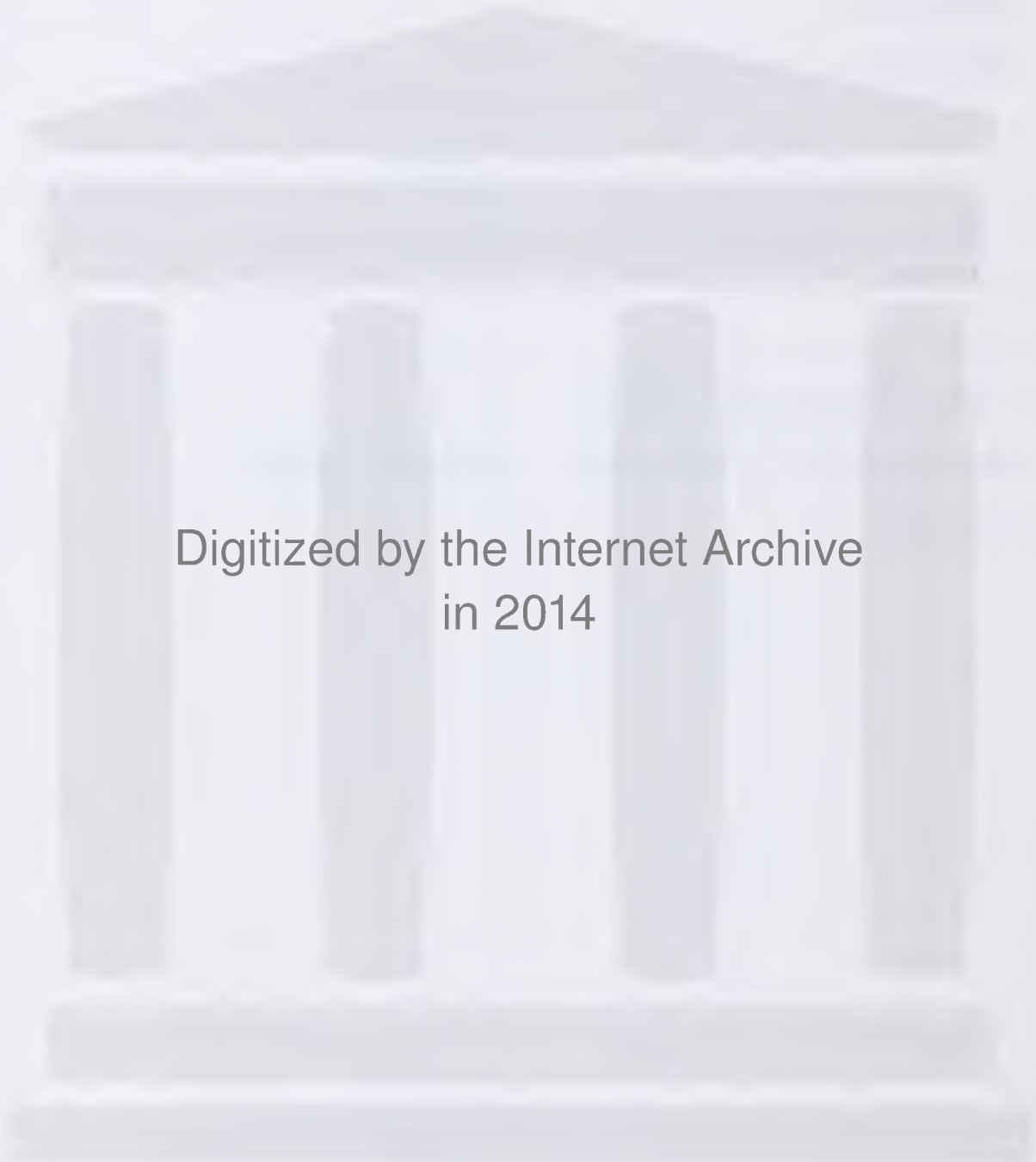

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I. INTRODUCTION

On April 23, 1976, the Anaconda Co. applied for an additional hard rock mining operating permit for its Berkeley complex in Butte. On July 28, 1976 the Department of State Lands (DSL) indicated that the application was complete. A permit map is shown on the following page and indicates that the company wishes to permit:

	Approx. Acreage
Tailings pond expansion (north of the pit)	669
Leach dump expansion (east of the pit)	205
Waste dump expansion (west of the pit)	174
Southeast buffer zone	293
West buffer zone	69
New Leach dump (McQueen area)	70

In addition the Anaconda Company is requesting that the precipitator and concentrator previously permitted by DSL in accordance with the Hard Rock Law be removed from the permit area. The Company believes that Hard Rock Act does not require them to have an operating permit for such structures.

The Anaconda Co. has applied for this new operating permit to facilitate continued operation of their Berkeley mining complex. No expansion of the Berkeley pit itself into previously unpermitted areas is included in this permit request.[1/]

II. LEGAL CONCERNS

DSL administers Montana's Hard Rock Mining Act, (Title, Chapter 12, R.C.M. 1947) and has adopted Rules and Regulations pursuant to the Act. A significant purpose of the Act is to ensure that the usefulness, productivity

and scenic values of all lands and surface waters involved in mining and mining exploration under the jurisdiction of the state ***"receive the greatest reasonable degree of protection and reclamation to beneficial use."

DSL is required to evaluate operating permit applications for conformance with the reclamation standards prescribed in the Hard Rock Mining Act and the Department's Rules and Regulations. DSL may deny an operating permit if:

1. The plan of development, mining or reclamation conflicts with the state water and air purification standards (Section 50-1214 R.C.M. 1947).
2. The reclamation plan included in the permit application does not provide an acceptable method for accomplishment of reclamation as required by the Act (Section 50-1214 R.C.M. 1947).

To help ensure compliance with the Act a performance bond is required of an applicant (Section 50-1211 R.C.M. 1947) and DSL is required to make periodic inspections.

DSL rules implementing the Montana Environmental Policy Act (Title 69, Chapter 65 R.C.M. 1947) requires that a Preliminary Environmental Review be prepared on certain Departmental actions in order to determine whether they will have a significant effect on the quality of the human environment (M.A.C. 26-2.2(18)-P280). If such a significant effect is determined, a draft Environmental Impact Statement will be prepared.

III. LOCATION

Anaconda Co.'s Butte Complex is located in Silver Bow County, immediately north and east of the city of Butte, Montana (see the map following page 1). Butte is located on the western slope of the Rocky Mountains; the Continental Divide is approximately two miles to the east of the city. The valley south of Butte (Silver Bow Creek drainage) is the upper extension of the Clark Fork River, which is part of the Columbia River system.

THE ANACONDA COMPANY
BERKELEY COMPLEX
Butte, Montana

T.4N., R.8W.; T.4N., R.7W.;
T.3N., R.8W.; T.3N., R.7W.;
SILVER BOW COUNTY

TOPOGRAPHIC BASE MAP IS SHEET 2D OF THE BUTTE, ANACONDA MAP OF JULY 29, 1957

SCALE: 1" = 1000'

PREPARED FOR THE ANACONDA COMPANY BY:
ENVIRONMENTAL CONSULTANTS,
MONTANA TESTING LABORATORIES

MAP WORK BY: OESIGN ASSISTANCE

Overlay No. 1
Permit Area
January 1973

PERMIT AREA = 2816 ACRES

ORIGINAL PERMIT BOUNDARY

Overlay No. 2
Permit Area #00030
January 1975

CURRENT PERMIT AREA = 2816 ACRES

BONDED AREA = 2155 ACRES

BOUNDARY AMENDMENT #001 JULY 1974

AMENOMENT #002 = 34 ACRES JULY 1974

PROPOSED AMENDMENT #003 = 165 ACRES JULY 1976

Overlay No. 3
Permit Area #00030A
January 1976

PROPOSED NEW PERMIT BOUNDARY
NEW PERMIT AREA = 1477 ACRES

PROPOSED NEW BONDED AREA OF 1477 ACRES AND AREAS TO BE NEWLY DISTURBED

Yankee Doodle Creek
Silver Bow Creek
RESERVOIR INFLOW
DIVERSION DITCH
T.4N. R.8W.
T.3N. R.8W.
TAILINGS POND
Precipitator Plant 60 Acres
Concentrator Plant 105 Acres
BERKELEY PIT 8/1/74
Alice Dump
Walkerville
MAPLE
GARFIELD
McQueen Detail
(See the Narrative)
UNCONTROLLED REAL ESTATE JANUARY 1976
Butte, Anaconda & Pacific RR
Northern

Areas included in the permit application lie within portions of Sections 28, 29, 30, 31, 32, and 33 T. 4 N., R. 7 W.; Sections 4, 5, 6, 7, 8, 9, 16, 17 and 18, T. 3 N., R. 7 W., and Section 13 T. 3 N., R. 3 N., R. 8 W., Montana Principal Meridian.

IV. HISTORY

The history of the Anaconda Co. and Butte Copper Mining operations are integral parts of the colorful history of Butte - the copper camp and the city. Two early histories of Butte which the Department adopts by reference are The War of the Copper Kings by Glasscock[2/] and Twentieth Century Montana, A State of Extremes by Toole[3/].

By the mid 1950's copper smelting and concentrating technology had improved to the extent that low grade ores could be profitably mined and the Berkeley Pit was opened in 1955 to supply such ores. As the pit has grown wider and deeper, the ore recovered has become lower in grade.

V. MINING PLAN

The Berkeley Pit is worked in a multiple bench method. Rock is drilled, blasted and loaded into haul trucks. Depending on its copper content, rock is hauled to waste dumps, leach dumps or to the crusher at the Company's concentrator.

Most of the area applied for is proposed to be used to expand the tailings pond, leach dumps and waste dumps. In addition a small proportion of the proposed permit area would provide a buffer zone around the pit. Portions of the proposed buffer zone is currently being used as a water utility corridor but has never been previously bonded.[1,4]

VI. DESCRIPTION OF AND IMPACTS ON THE PHYSICAL ENVIRONMENT

A. Topography

The southeastern corner of the proposed permit area consists of former residential areas that have been leveled (5620 - 5700 ft. elevation) and the

lower slopes of East Ridge (up to about the 6300 foot elevation). These slopes vary from 1:6 to 1:2. Several mine and smelter waste dumps dominate this area. See the map following page 1.

The northern part of the proposed permit area consists of narrow and steep stream valleys (18% slope). The tailings pond would be expanded by allowing water to back up these valleys. The topography is already changing in much of this area north of the Berkeley Pit because it has been disturbed by the existing tailings pond and waste dumps.

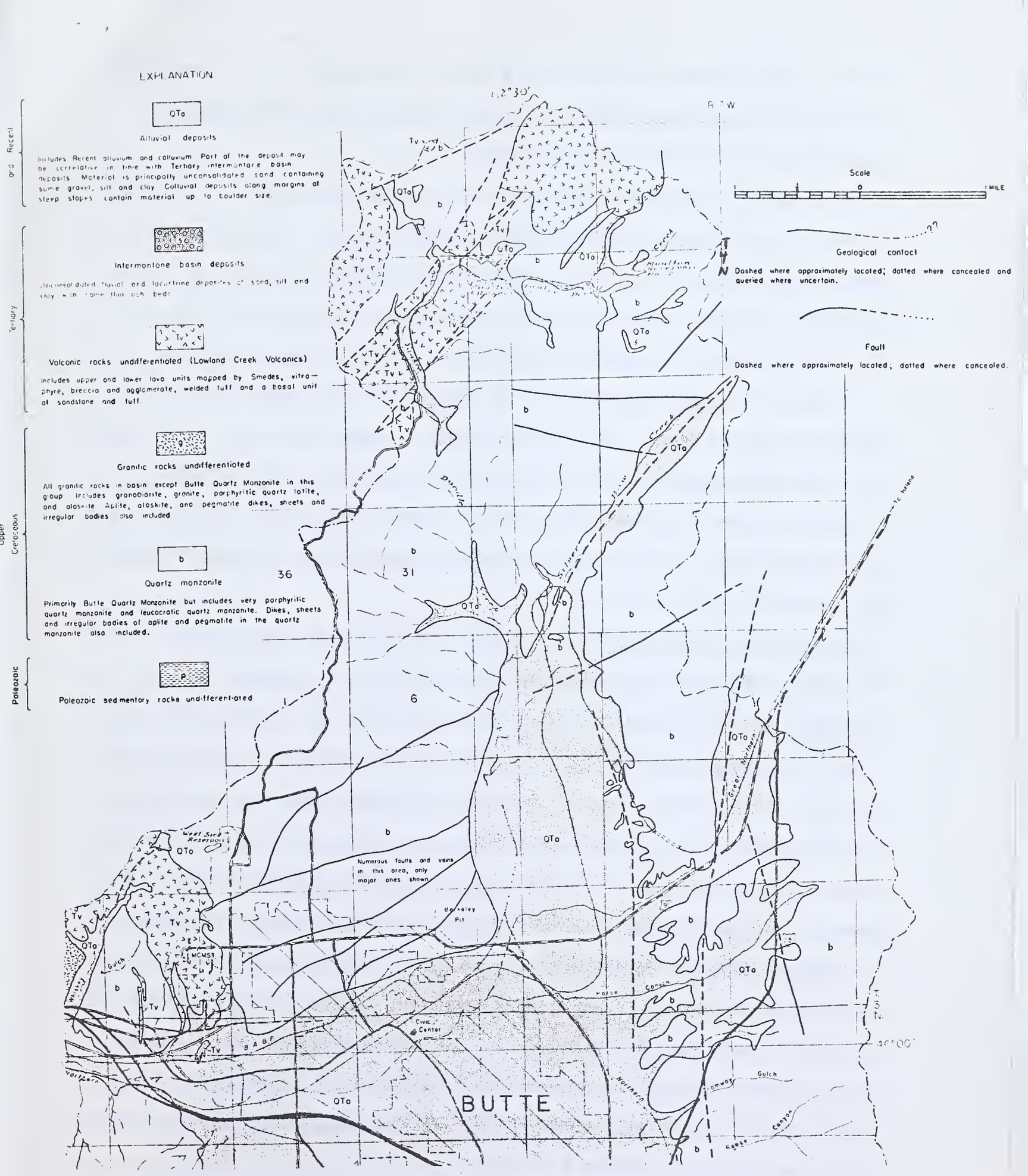
The western part of the proposed permit area is a narrow (200 ft.) band of land that has been used for utility and water lines while the southwest corner contains an area that has been leveled for the repair yards.

Were the permit granted topography within the permit area would be greatly changed. In the southeastern corner flat areas would be converted to hills of leach and waste material while the northern portion would be inundated by the tailings pond. Other areas would be covered by waste rock thus changing their elevations and configurations.

B. Geology[5/]

One of the major tectonic features of southwestern Montana is the Boulder Batholith of Upper Cretaceous age. Butte is situated in the southwestern corner of this pluton, where much of the hydrothermal ore deposition associated with its emplacement occurred.

The Boulder Batholith is a composite feature whose several intrusives were emplaced in stages. The primary rock type is the Butte Quartz Monzonite, flanked to the north and south (in the general areas of Helena and Twin Bridges) by earlier granodiorite and, in the north, mafic intrusives. A second, younger stage of quartz monzonite intrusion is represented by irregular


EXPLANATION
QTo
Alluvial deposits
Includes Recent alluvium and colluvium. Part of the deposit may be correlative in time with Tertiary intermontane basin deposits. Material is principally unconsolidated sand containing some gravel, silt and clay. Colluvial deposits along margins of steep slopes contain material up to boulder size.
Intermontane basin deposits
Unconsolidated fluvial and lacustrine deposits of sand, silt and clay with some thin rock beds.
Tv
Volcanic rocks undifferentiated (Lowland Creek Volcanics)
Includes upper and lower lava units mapped by Smedes, vitrophyre, breccia and agglomerate, welded tuff and a basal unit of sandstone and tuff.
g
Granitic rocks undifferentiated
All granitic rocks in basin except Butte Quartz Monzonite in this group. Includes granodiorite, granite, porphyritic quartz latite, and aloskite. Aplite, aloskite, and pegmatite dikes, sheets and irregular bodies also included.
b
Quartz monzonite
Primarily Butte Quartz Monzonite but includes very porphyritic quartz monzonite and leucocratic quartz monzonite. Dikes, sheets and irregular bodies of aplite and pegmatite in the quartz monzonite also included.
P
Paleozoic sedimentary rocks undifferentiated
Recent and Pleistocene
Tertiary
Upper Cretaceous
Paleozoic
Scale
1 MILE
Geological contact
Dashed where approximately located; dotted where concealed and queried where uncertain.
Fault
Dashed where approximately located; dotted where concealed.
Numerous faults and veins in this area, only major ones shown
BUTTE
Civic Center
Berkeley Pit
West Side Reservoir
Missoula Gulch
Timber Butte
Dublin Gulch
Conway Gulch
Rocker Canyon
Great Northern
Northern Pacific
Montana Street
Excelsior Street
Arizona Street
Wyoming Street
Idaho Street
Utah Street
Nevada Street
Colorado Street
Texas Street
Creek
Canyon
Gulch
36
31
6
T 4 N
R 7 W
112°30'
46°00'

GEOLOGICAL MAP

Botz, M. K., 1969, Hydrology of the Upper Silver Bow Creek Drainage Area, MT Bur. Mines and Geol. Bull. 75.

bodies in the extreme north and extreme south of the batholith. Late-magmatic alaskite-aplite bodies are found in all major intrusives, but are primarily associated with the Butte Quartz Monzonite.

The center of Anaconda's mining activity in the Butte District is divided in two by the Continental Fault, a major structural feature which runs north-south through Butte and gradually curves to the southeast south of the city. Anaconda's mining operations have historically been centered west of the fault in an area of highly fractured, faulted, and mineralized quartz monzonite.

Primary ore deposition in this area occurred in two stages, called Main Stage and pre-Main Stage. The latter occurred at deep levels in an area centered near the Anaconda shafts and is characterized primarily by quartz-molybdenite veinlets. Chalcopyrite and pyrite are also present along with a variety of non-metallic minerals. Veinlets rarely persist for more than a few feet and tend to have random dips and strikes.

Main Stage mineralization, which began later than but does overlap the pre-Main Stage, represents the bulk of primary ore masses. It appears that the structural grain of the district was established prior to the Main Stage and Sales[6/] divided the ore-bearing veins into two units based on orientation and age. The first of these - called the Anaconda System - comprises east-west striking features of which five principal veins, along with a number of smaller veins, have been extensively mined. The second system - the Blue Veins - are predominantly oriented NW-SE and consistently displace the Anaconda System with left-lateral offset. Displacement appears most intense near the center of the mining district, becoming less apparent towards peripheral areas. Oreshoots on the Blue Veins are about 5-20 feet wide and 1000 to 2400 feet long. Although not as productive as veins of the Anaconda System, much ore has been removed from Blue Veins. A third, less important set of veins and faults is the Steward System, which shows a northeast strike.

Sales (1913)[6/] divided mineralization into three roughly concentric zones: (1) a central zone "occupying an area of altered granite in which the ores are characteristically free from sphalerite and manganese minerals"; (2) an intermediate zone "in which the ores are predominantly copper but are seldom free from sphalerite"; and (3) a peripheral zone "in which copper has not been found in commercial quantities." These three zones are actually situated along an axis of symmetry striking about N60W and extending from somewhere in the vicinity of the Pittsmont Shaft to the Mountain Con Shaft (Meyer et al, 1968)[7/]. Copper minerals in the central and intermediate zones include bornite, covellite, enargite, chalcocite, and chalcopyrite. The last increases outward towards the edge of the intermediate zone. The peripheral zone has been mined for manganese (rhodochrosite), silver (native), and zinc (sphalerite).

A supergene enrichment blanket overlies the hypogene mineralization from the area of the Berkeley Pit eastward past the Continental Fault. This blanket is the result of strong attack by sulfuric acid generated by oxidation of pyrite. The dominant supergene mineral is chalcocite with some covellite located mainly near the bottom of the oxidation zone. The thickness of the blanket varies considerably due to vein and fault control of solution flow but, in general, oxidation terminates at depths of between 200 and 300 feet.

Past and current open pit and underground mining have removed and relocated substantial portions of the geologic substructures in the Berkeley Complex. The Anaconda Co. is currently removing 61.6 million tons of waste rock, leach material and ore annually from their Berkeley Pit operation[8/]. This permit, as proposed would facilitate the continuation of open pit mining in previously permitted areas principally by approving the creation of new leach and waste dumps for materials removed from the pit.

Given the reclamation of existing and future pit areas, substantial changes in the physical characteristics of the geologic substructure within the previous pit area will occur.

The amount of concentrate copper and precipitate copper annually removed and recovered from the Berkeley Complex operations amounts to approximately 104.5 million tons. Mining of such resources represent an irreversible depletion of the world's unmined mineral supply.

C. Soils

The soils of interest in the area of the permit consist of 3 series and complexes thereof: Carbo, Kenspur, and Lucky series (see the soils map on the following page). These soils have developed from granitic parent materials either in place or after reworking (alluvium). Profile descriptions indicate that the Carbol and Lucky soils tend to be acid in reaction with some accumulation of clay in the B horizons (see Appendix A). Permeabilities of all 3 series of soils range from moderate to moderately rapid.

The most obvious effect of mining activity on these soils is destruction of the soil profile and the intimate chemical and biological relationships associated with it[9/] assuming, of course, that suitable topsoil materials will be salvaged. Information that is available suggests that in many areas where "undisturbed" soils exist, at least 6" of suitable topsoiling materials are available for salvage. Moreover, it appears that up to 2+ feet are available in some cases (see profile description of Lucky series and the narrative on the Kenspur soils in Appendix B).

Topsoil materials suitable for salvage would include all horizons in the soil profile which have acceptable characteristics for revegetation purposes. For example, this would include the A1 and B21t horizons in the typical profile description of the Carbol series and the A11, A12, B2t, and C1 horizons

Soils Overlay
Permit No. 00030A

Legend:

54E - KENSPUR STONY LOAM, 9 - 35 PERCENT SLOPES
61C - CARBOL AND LUCKY SOILS, 5 - 9 PERCENT SLOPES
61E - CARBOL AND LUCKY SOILS, 9 - 45 PERCENT SLOPES
62F - ROCK OUTCROP, CARBOL COMPLEX, 35 - 75 PERCENT SLOPES
153B - KENSPUR COARSE LOAMY SAND, OVERWASH
MW - MINE WASTE

(See the Narrative)

T. 4 N.
R. 8 W.

T. 3 N.
R. 8 W.

T. 4
R. 7

T.
R.

61E
62F
61C
153B
MW

TAILINGS POND

WASTE DUMP

PREPARED LEACH BASE

BERKELEY PIT
6/1/74

Alice Dump

Walkerville

Centerville

GARFIELD

MAPLE

CITY LIMITS

Butte & Pacific RR

Butte, Anaconda & Pacific RR

Northern

McQueen Detail
(See the Narrative)

UNCONTROLLED REAL ESTATE
JANUARY 1976

1" = 500' scale
500 0 500 1000 feet

Overlay No. 3
Permit Area #00030A
January 1976

PROPOSED NEW PERMIT BOUNDARY
NEW PERMIT AREA = 1477 ACRES

PROPOSED NEW BONDED AREA OF 1477 ACRES
AND AREAS TO BE NEWLY DISTURBED

in that of the Lucky series (see Appendix A). However, these profiles may vary from one location to another, and thus actual salvage depths in any specific area would have to be determined by on-site observation. In addition, prescriptions for salvage depths should be supplemented by quantitative analytical data such as soil pH, texture, soluble salt content, etc.

In view of the probable undesirable nature of dump waste materials and tailings, it is desirable and necessary that all suitable topsoiling materials be salvaged and stockpiled for revegetation purposes. This would provide a margin of safety for future revegetation efforts by not having to rely strictly on revegetation on raw mining wastes, the success or failure of which is far from being known.

The Anaconda Co. has suggested that the soils of the Carbol - Lucky complex at the north end of the permit area be used as an in-place sealant for the tailings pond instead of salvaging these soils. This is questionable in view of the moderate to moderately rapid permeability of these soils (see Appendix B). Moreover, the slurry pumped into the pond should provide abundant fine-textured material for sealing the bottom of the pond after topsoil is salvaged. Anaconda Co. could also utilize the fine-textured alluvium on the north and east sides of Berkeley pit as a sealant (see soils section of the permit application[1/]).

The same arguments could be used against the use of topsoil as a base for leach pads.

D. Climate[10/]

Butte is located in a high mountain basin whose bottom elevation is 5500 feet. The Continental Divide encloses the basin on the north, east and south. Because of the altitude the weather is always cool, the normal freeze-free period is 60 days, although freezing temperatures can be expected at any

time of the year. The average temperature for January is 15.1° F. and for July is 62.5° F. Below zero readings are common in the winter although a prolonged period of extreme cold is usually followed by a chinook, which is a strong, dry and warm wind that forms on the lee slope of mountain ranges.[11/] During the summer the temperature may reach 90° F. but the evenings are cool. Average annual precipitation is 12-17 inches, two-thirds of which falls during the months of May through September. This precipitation usually takes the form of rain but snow and hail have been reported every month of the year.

Fugitive dust from copper mining and related activities at Butte may become condensation nuclei if the particles are hygroscopic and sufficient water vapor is available in the atmosphere. Such nuclei could cause precipitation to increase on the windward side of the mountains. The increased surface area of the tailings pond will allow a greater amount of water to be evaporated which may also increase precipitation on the windward side of the mountain.

No major impacts upon Butte's climate or the regional climate however are anticipated should the subject Hard Rock operating permit application be approved by DSL.

E. Air Quality

The Montana Department of Health and Environmental Sciences has studied the Butte area for a number of years. The work has been mostly confined to the study of airborne particulate matter. The major source of particulate matter appears to be the Berkeley Pit and its associated mining operations. Other air pollutants, e.g. hydrocarbons, carbon monozide and oxide of nitrogen, are estimated to be present in fairly high concentrations. Pedco-Environmental Specialists (1976)[12/] estimated that particulates from the pit alone average over 6,000 tons per year. Such particulate matter settles over the city and may be reentrained by vehicular traffic on city streets.

Since the Butte air mass is confined by mountains on three sides, cold air drainage into the valley produces frequent and severe fall and winter inversion layers. It is not uncommon during cold months to have stable high pressure cells accompanied by low wind speeds to further restrict the mixing of pollutants for several days at a time.

Other Butte sources include asphalt and concrete plants, vehicular traffic, and home heating and excavating operations. Although there are miles of unpaved roads in the areas which account for some emitted particulates, the major portion of the particulate matter eminates from the Berkeley Pit and its associated mining operations.

State and National air quality standards are presented on the following page for total suspended particulates (in micrograms per cubic meter).

Table 1.--Air Quality Standards for Total Suspended Particulates

	State of Montana	Federal Primary	Federal Secondary
24-hour	200*	260*	150**
Annual	75	75	60

* Not to be exceeded more than 1% of days of a year
**Not to be exceeded more than once per year

Other air quality standards apply but since detailed air pollutant measurements have not been made for these other parameters, they are not listed.

1. Total Suspended Particulates

The following total suspended particulate data have been recorded for Butte. Refer to the map (page 15) for sampling station locations:

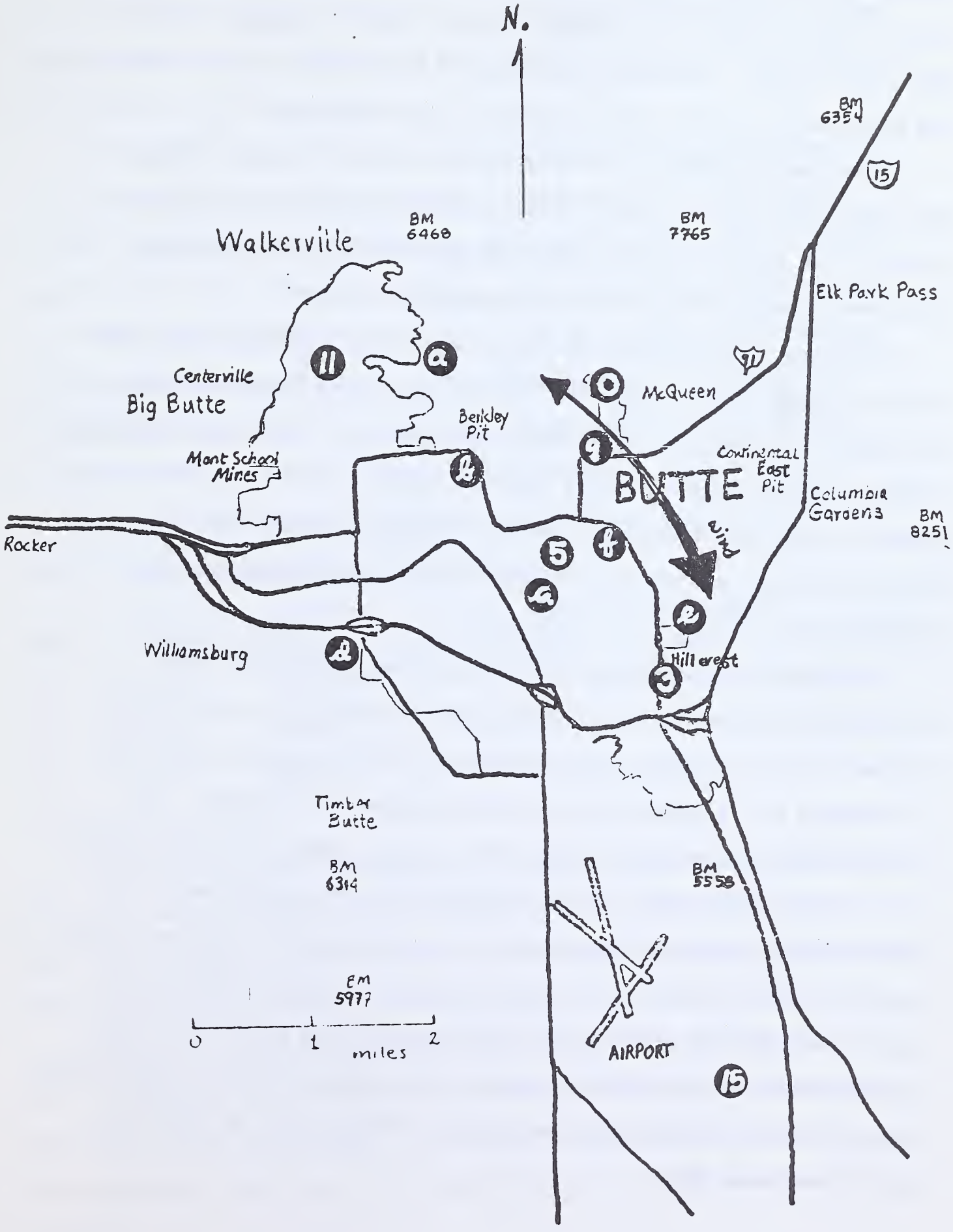
Table 2.--Data - Total Suspended Particulates (In Micrograms per Cubic Meter of Air

	1970	1971	1972	1973	1974	1975	1976
State Stations							
0 - McQueens			194*				
3 - Hospital			95		37.7**	63.0	63.4*
5 - Greeley School		99			92.3	100.2	109.6*
11 - Residence				32	40.1	43.4	66.7*
15 - Residence						17.7	17.9*
g - Harrison School					115.6*		
Company Stations***							
a. Pit-top					46.9		
b. Belmont		41.1	82.1	90.5	60.7*		
c. Race Tr. Fire Sta.		48.5*	67.8	96.1	73.9*		
d. MPCo	50.5	36.5	45.9	51.6	44.3		
e. Hillcrest						18.5*	
f. Alpine						59.8*	
g. Harrison School		24.5*	67.1	95.1			

* Partial year's data.

** This station was moved from Hillcrest.

*** It is impossible to compare Anaconda Company data to air quality standards since the Company's Whatman filters restrict air flow more than do the EPA recommended fiberglass filters. Due to this restricted flow, larger particles are not drawn into the sampler; and the resultant total suspended particulate data would be considerably lower than comparable fiberglass collected data.



Air Quality Monitoring Stations

For the State data included in Table 2, it is noted that highest total suspended particulate values are sustained at the Greeley School - a rather densely populated area. The Harrison School, since torn down, also gave very high readings. Distances to the edge of the Berkeley Pit were respectively and approximately 1 and ½ miles for the two school stations.

Winds near the Berkeley Pit tend to blow from the NW to the SSE and visa versa (see p. 15). A bowl effect is created by the high mountains to the north and east of the city, such that wind speeds are retarded and often move counter to the prevailing southwesterly wind.

Stations to the northwest of the pit are 500 to 1,000 feet higher than general pit operations. These stations are often above inversion layers and height mitigates particulate matter concentration. The hospital station to the southeast is approximately 2 miles from the pit. Particulate matter generally falls off exponentially with distance and the data shows the hospital not to be as heavily influenced by pit operations as the close stations.

Anaconda Co.'s own data confirms the hypothesis that the closer one gets to the Berkeley Pit the higher concentrations of particulates are observed. Using preliminary data submitted to the Air Quality Bureau by the Anaconda Co., a comparison can be made between several sites. The Montana Power Co. site (the furthest from the Pit) showed an annual geometric mean of 52 ug/m^3 for 1973. As one approaches the pit from the west, the Belmont station increased dramatically to 91 ug/m^3 for the same time period. Two other stations surrounding the pit, the Race Track Fire Station (just south of the pit) and the Harrison School Station (just east of the pit), showed concentrations of 96 and 95 ug/m^3 respectively for 1973. The Hillcrest station, located further away from the pit, exhibited only 19 ug/m^3 from August to December 1975.

During December of 1974, trace elements analyses were made from Butte area particulate samples. Copper to iron ratios were compared with distance from the Berkeley Pit. This limited data showed very definite ratio increase as one neared the pit operation.

The McQueens site in 1972 was located 100 feet from the centerline of utilized haul road. The 24-hour readings were documented by the operator and with the National Weather Service as per precipitation. Even on days of snowfall fairly high values were obtained. For the McQueens station it was found that even with moisture on the road, each haul vehicle contributed to the suspended particulate values. It would follow then that air quality standards could be attained by a reduction in the number of haul vehicles utilized - haul road watering has not eliminated particulates in the air.

Greeley School 24-hour violations are shown in Table 3.

Table 3.--Greeley School 24-Hour Violations

Year	High (ug/m^3/month)	2nd High	Number of Violations Over 260 ug/m^3	200 ug/m^3	150 ug/m^3
1974	966/March	369/Sept.	8	24	25
1975	368/Dec.	331/Nov.	4	9	22
1976*	285/Feb.	255/Jan.	2*	3*	11*

* Six months data only.

Since Butte has been designated an Air Quality Maintenance Area[13], it must meet national secondary particulate air quality standards by July 1, 1985. An attainment-maintenance plan to this effect shall be written by July 1, 1977 by the Montana Air Quality Bureau.

Using the "roll-back technique"[14] where 18 ug/m^3 is considered an annual background value for Butte, the 2nd high violation level is used at the 24-hour level, and 45 ug/m^3 is considered a background 24-hour value, we find particulate reductions in the Butte-Greeley area should have been as follows:

Table 4.--Roll-Back Values for Particulate Emissions

	Annual	24-Hour
1974	43.5% reduction	67.6% reduction
1975	48.9% reduction	63.3% reduction

This information implies that considerable reductions in particulate emissions will be necessary.

Road dust is and has been a problem in and around Butte. But in the last two years, the city has drastically reduced its usage of winter sanding and has cleaned Butte's streets rather often. Such improvements seem to have little to no affect on the annual particulate values as seen in Table 2.

The Silver Bow County winter sanding program includes the Greeley School. Although the county has not yet curtailed such sanding, it will so endeaver this coming winter.

During the winter of 1974, the Air Quality Bureau considered the Greeley School area for particulate matter. Since the area streets were generally not cleaned in the warmer months, snow cover was noted and data was correlated to the absence of street dust. Gilman Excavating and Continental Concrete operations were shut down during the sampling period. The school is fairly well isolated from Continental Drive and very little to no sanding material was applied to the icy streets near the school. Fifteen to twenty percent of the 430 school children were driven to school during the period.

Findings for the sampling period indicated approximately a 32 ug/m^3 particulate reduction due to the absence of street dust and other area particulate emission sources. It appears that the Berkeley Pit and related operations accounted for some 80 to 90 micrograms of suspended particulates per cubic meter of air or about 65-70% of the particulate matter sampled at the Greeley School.

2. Hydrocarbons

The presence of hydrocarbons in Butte can be noted by the characteristic blue haze observed over the city during inversion periods. People have complained of diesel odors up to 4 miles south of the mining operation.

Emissions from the haul trucks can be estimated by the following:

emissions = (41688 gal/day)[15/] (94 lb/10^3 gallon)[16/]
= 3,854 lb/day

3. Oxides of Nitrogen

The presence of oxides of nitrogen is partially substantiated by the brown haze which occurs over the area. The frequency and severity of the inversions suggest that this may be a pollution problem.

Emissions from the haul trucks alone can be estimated by the following:

emissions = (41688 gallon/day)[15/] 370 lb/10^3)[16/]
= 15,425 lb/day

4. Ozone

The observance of a brownish haze over Butte also leads one to suspect that ozone may be a contributing factor knowing the possibility of having a significant amount of hydrocarbons in the air. The haze is somewhat reminiscent of the smog that occurs over Los Angeles. It has not been established that it is an oxidizing type of atmosphere that is needed to catalyze photochemical reactions simulating those in L.A. The potential, nevertheless, does exist.

The high elevation of Butte indicates the possibility of generally high ozone production. Monitoring in Billings, Montana, has yielded a reasonably high ozone content (0.07 ppm in mid-afternoon - 1-hour standard is .08 ppm). Billings is 2,600 ft. lower than Butte which indicates that Butte is more susceptible to ozone production.

5. Carbon Monoxide

The presence of carbon monoxide can be estimated by using the haul trucks in the Pit. This number is obviously below the actual amount since it will not consider the effects from automobiles in the surrounding area.

$$\text{emissions} = \underset{5{,}419\ \text{lb/day}}{(41688\ \text{gallon/day})}^{15/} \quad (130\ \text{lb}/10^3)^{16/}$$

Assuming that the area acts as a box model during the inversion episodes, the carbon monoxide would be evenly distributed throughout the airshed, with the following dimensions:

16 square miles x 300 ft. mixing layer.

The concentration of CO from the haul trucks alone would be about .5 ppm. This is a rather large number considering it is from only one source evenly distributed through 16 square miles.

6. Health Effects

The population of Silver Bow County is concentrated in Butte, Walkerville, South Butte, Rocker and other close-in areas. Because air quality standards were established primarily to protect health, a brief look at some county health statistics is relevant to this discussion.

The death rate from respiratory diseases is 51% higher in Silver Bow County for all ages and sexes than for the state as a whole. Furthermore, asthma, emphysema, bronchitis, and circulatory diseases account for a 42% higher than normal death rate in Silver Bow County when compared to the death rate for all of Montana[17/].

An even more interesting statistic is death rate caused from cancer of the respiratory system. In Silver Bow County such a death rate is 80% higher than the average for the state in all ages. Among females,

the average is 148% above the state average. This trend among females is also evident in circulatory diseases and pneumonia. This data would seem to refute the idea that increased death rates are due entirely to the working conditions of men. It suggests a more generalized cause or causes for the above diseases in the Butte area.

7. Summary

Data for the Butte area has been reviewed. Numerous and high violation levels near the Berkeley Pit indicate substantial particulate emission reductions are necessary. Severe and frequent inversions over the area with very little mixing and dispersion of pollutants reinforces the need for such reductions. Hydrocarbon, oxides of nitrogen, carbon monoxide and ozone are estimated to also be present. Current respiratory and related health problems in Butte are much higher than for the rest of the state.

Emission reductions are necessary to meet applicable standards.

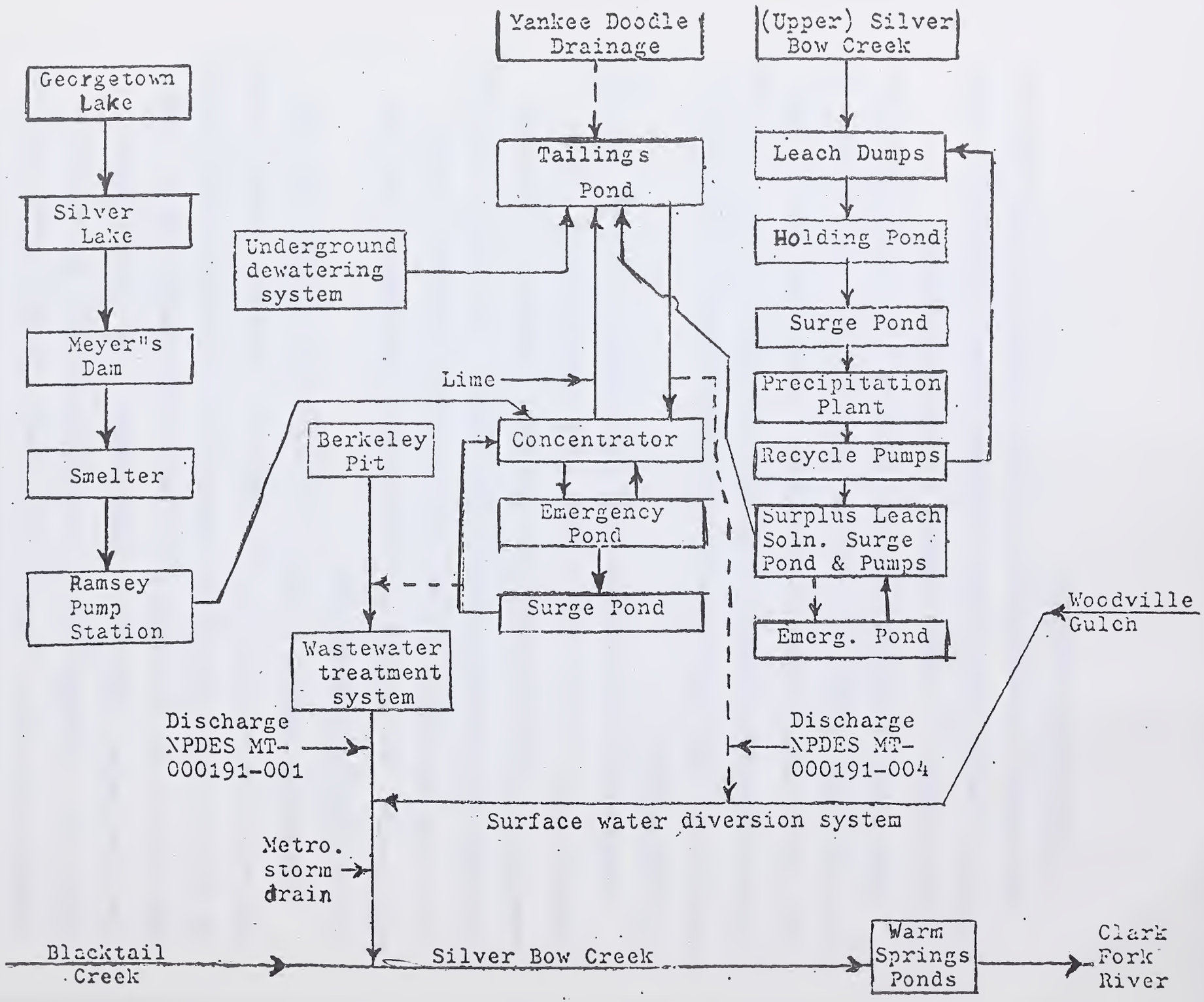
F. Water Quality and Quantity

Water quality and quantity below the Butte operations has been extensively discussed in the Department's Final Environmental Impact Statement (EIS) on the Continental Complex.[5/] Such information is adopted by reference.

Upper Silver Bow Creek is officially recognized as the upstream extension of the Clark Fork River[18/]. The creek begins near the Continental Divide a few miles north of Butte and flows into Anaconda Co.'s leach dump system. Silver Bow Creek flows at an estimated 35 gpm, and small unnamed drainages, contribute and additional 120-170 gpm to the total Silver Bow drainage[1/] (See diagram on the following page).

Yankee Doodle Creek originates along the Continental Divide and flows into Moulton Reservoirs 1 and 2, about 2 miles above the tailings pond. These reservoirs are part of the Butte water supply and, therefore, the discharge downstream is controlled by the Butte Water Company. This discharge flows into the tailings pond where it becomes part of the Weed Concentrator's process make-up water. The average flow in Yankee Doodle Creek above the diversion ditch is estimated to be 40-50 gpm.

The tailings pond dam is checked for stability and soundness four times each year by two consulting firms.[4/] Impacts on surface water includes raising the level of water in the tailings pond by 150 ft and flooding 80 and additional 5000 feet of Silver Bow Creek and 4000 feet of Yankee Doodle Creek.[1/] Water from Silver Bow and Yankee Doodle Creeks presently flow into the Berkeley Complex water - wastewater system so this application does not represent a reduction in the flow in lower Silver Bow Creek. The water surface area will be increased, thereby increasing the amount of water evaporated which may affect the local climate.



Flow sheet of Berkeley Complex water-wastewater system, January 1976
Source: The Anaconda Company

Water in shallow aquifers existing in this geologically faulted area would be affected by infiltration from the tailings pond until such time as fine textured tailings material seals the pond. These aquifers are in most cases intercepted by either underground mines or the Berkeley Pit, and the water is then pumped to one of the company's wastewater treatment facilities.

The Water Quality Bureau of the Montana Department of Health and Environmental Sciences (MDHES) has examined maps submitted by The Anaconda Company as part of their permit application. The Water Quality Bureau feels that the Company's expansion plan will not create water quality problems.*

*Memo from Don Willems, Chief, Water Quality Bureau, MDHES to Mr. Leo Berry, Jr., Acting Commissioner, DSL, September 16, 1976.

VII. IMPACT ON THE BIOLOGICAL ENVIRONMENT

A. Wildlife

Direct-observation wildlife surveys of the Berkeley complex area, were conducted under adverse snow conditions on January 8 and 14, 1976 (see Appendix B). A third survey was conducted May 6, 1976, to expand the data base of the earlier surveys, and document any seasonal change in wildlife use. A description of wildlife survey methods is given in Appendix B and a map showing each of the survey routes is included on page 26.

1. January 1976 Observations - Entire Permit Area [9/]

The proposed area is completely disturbed and is affected by continuous activity associated with mining operations. Rabbit tracks (possibly white-tailed jackrabbit, Lepus townsendii) were observed within the permit area on January 8, 1976. It is possible that some avian species utilize vegetation growing along fencelines or in undisturbed "pockets" within the area. These poor-quality habitat conditions will not be significantly affected by the proposed action.

The leach dump extension site, which is nearly evacuated by Company purchase of residential property, may provide habitat for small mammals and birds which utilize trees and shrubs, lawns, vacant lots and abandoned buildings for cover. No birds or mammals were observed January 8 or 14, 1976; domestic cat and dog tracks were present.

The tailings pond expansion area contains the best potential wildlife habitat in the proposed permit area, particularly the land north of the pond. Vegetative community types from the drainages and slopes above the pond extend continuously to the pond edge. Small mammal and avian usage may be interrupted by limited human disruption of the area. Expansion of the area by the tailings pond will inundate this habitat to the 6240 foot contour.

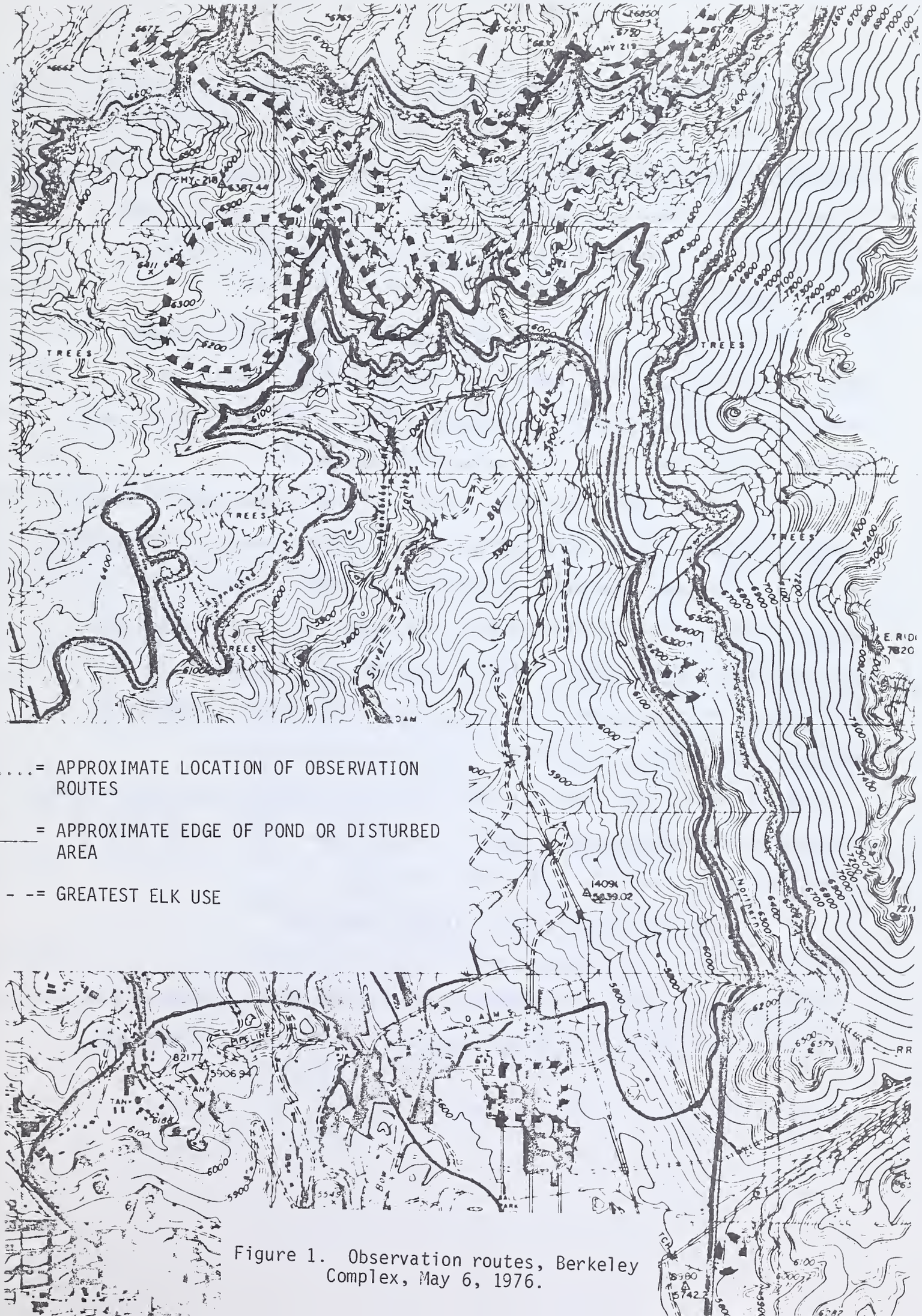


Figure 1. Observation routes, Berkeley Complex, May 6, 1976.

Proximity to mining operations precludes constant use of the area by larger mammalian species. Big game species occurring in the area include mule deer (Odocoileus heminonus) and, occasionally, elk, (Cervus canadensis). In the past, elk have been observed on the ridge to the east of the tailings pond; however, it is doubtful that they frequent the pond area (Jim Cole, personal communication).

During a January 8, 1976 survey of the area, blackcapped chickadees (Parus atricapillus), common crow (Corvus brachyrhynchos), rabbit tracks (probably mountain cottontail), (Sylvilagus nuttalii), and canine tracks were observed. No big game animals or tracks were observed.

During a second survey conducted January 14, 1976, blackcapped chickadees, common crow, rabbit tracks and droppings (again, probably mountain cottontail), and canine tracks were observed. In addition, microtine evidence (snow tunnels, wasseen, droppings beneath rocks and stumps) was found and one deer mouse (Peromyscus maniculatus). At only one location was evidence (two leaf nest, tracks, and snow tunnels) of red squirrel, (Tamiasciurus hudsonicus), recorded. Fox (Vulpes vulpes) tracks were found on the pond ice.

Several sets of deer tracks, along with light to moderate browsing evidence on several shrub species, were observed; droppings were found at one location. No positive identification of elk tracks were made.

2. May 1976 Observations - Tailings Pond Area[19/]

(1) Avian Species

Bird observations are presented in Table 5. All bird sightings were on the tailings pond route, no birds were seen east of the proposed leach dump,

Table 5. -- Species, number, and activity of birds observed, the Anaconda Company 1976 proposed permit area, May 6, 1976.

SPECIES	LOCATION	NUMBERS MALES	NUMBERS FEMALES	NUMBERS UNK.	ACTIVITY
Shoveler	Tailings Pond	2	2		Resting on water or were in flight
Bufflehead	Tailings Pond	1	1		
Lesser Scaup	Tailings Pond	1			
Ruddy Duck	Tailings Pond	7	6		
American Coot	Tailings Pond			8	
Eared Grebe	Tailings Pond			5	
Long-billed Dowitcher	Pond Shore			1	
Grouse (species unknown, probably ruffed; droppings observed in aspen groves)					
Downy woodpecker	Aspen Grove			1	Flight
Gray jay	Douglas Fir			1	Calling from perch - 2 species
Common crow	Over study area			2	Flight
Black-billed magpie	Over study area			2	Flight
Black-capped chickadee	Aspen Groves	Several flocks			Flight, feeding
Robin	Aspen Groves			20+	Flight, perching - 2 species
Horned lark	Sagebrush-grassland			3	Flight
Common junco	Aspen Groves	Several flocks			Flight, feeding

in the McQueen neighborhood, or south of Highway 91. Waterfowl seemed to be restricted to the bay where Yankee Doodle Creek entered the pond. Spring runoff from the Yankee Doodle drainage was apparently diluting the pond water in the bay enough to attract waterfowl.

Warblers, sparrows, and many other migratory bird species had not yet arrived in the locality. Aspens and shrub species were not leafed out, and observations were not restricted by foliage; therefore, the number of species present on the list is believed to be accurate, although the time frame of the survey precluded observations of nocturnal species (owls) and at dawn and dust periods.

(2) Elk, Deer and Moose

Most mammal observations were made north of the tailings pond; no observations were made in the McQueen neighborhood or in the disturbed area south of Highway 91.

Approximately 20 head of elk (Cervus canadensis) winter along the Continental Divide (Rampart Mountain) north and east of the tailings pond. Although pellet groups were scattered throughout the tailings pond area, the first two ridges paralleling Rampart Mountain and immediately west of Silver Bow Creek seemed to have greater concentrations of pellets and tracks than anywhere else (see map following p. 25). Five distinct sets of tracks were found along the western-most of the two ridges. The tracks had been made within 2-3 days of observation, as they had been somewhat deformed but not obliterated by rains preceding the survey. Evidence of browsing seemed greater on these two ridges than elsewhere, but no quantitative measurements were taken.

No recognizable deer tracks or pellets were observed, although some deer and elk pellet groups could have been confused.

One pellet group, probably moose (Alces alces), was found in a willow thicket along Yankee Doodle Creek.

(3) Coyote, Fox and Dog

Coyote (Canis latrans) scats and tracks were seen throughout the area. One coyote was observed fleeing along the ridge immediately west of Silver Bow Creek.

Tracks, possibly fox (Vulpes vulpes) were found on a dirt road bordering the pond.

Large (3-3¼ inch) canine tracks, probably domestic dog, were also found on the road.

(4) Other Mammals

Several aspen branches, cut and stripped of bark by beaver (Castor canadensis), were floating in the tailings pond near the site where Yankee Doodle Creek is diverted beneath the periphery road and into the pond. No bank slides, tree cuttings, or evidence of bank dens was found on shore.

One yellow-bellied marmot (Marmota flaviventris) was observed while it moved through rubble near a leach dump northeast of the pond. The marmot stopped several times to preen, and once to chew on a cardboard box.

Several pocket gopher (Thomomys talpoides) mounds were found along Yankee Doodle Creek.

Several chipmunks (Eutamias spp.) were seen near rock out-crops.

Two leaf nests, identified as red squirrel (Tamiasciurus hudsonicus) nests in the January 14 survey, were still present, although no squirrel activity was recorded. Aspen woodlands are not preferred red squirrel habitat, and it is not likely that the tailings pond area will support a significant squirrel population.

A small bunch of fur, keyed as raccoon (Procyonlotor) was found along Yankee Doodle Creek.

Rabbit (Lepus spp. or Sylvilagus spp.) pellets were occasional in aspen groves.

One shrew (species unknown) skull was found in a coyote scat.

The tailings pond area has been heavily grazed by cattled, as evidenced by droppings and range condition. Season of use is probably summer; no cattle have been observed on any survey to date.

One horse skeleton was found in a willow thicket near Yankee Doodle Creek.

3. May 1976 Observations - East of the Proposed Leach Dump[19/]

(a) Elk

Elk pellets were present; the frequency of pellet groups increased with altitude, probably in response to increasing forage and cover, and decreasing human activity.

(b) Other mammals

Coyote scats were found along a dirt road. There were weasel (Mustela spp.) scats on several large flat rocks on the area. There were pocket gopher mounds in man-made depressions and ditches throughout the area. Small rodent (mice, voles, etc.) evidence was very abundant - tunnels and runs, droppings, etc. One chipmunk was seen in a rock outcrop.

4. Summary

Most of the land included within the Berkeley Complex proposed permit area boundary cannot be considered desirable, or in many cases even existing, wildlife habitat. Some small mammals and birds undoubtedly utilize (at least seasonally) whatever habitat exists south of the tailings pond, but this use can hardly be considered significant in respect to overall population dynamics.

Furthermore, the land west and south of the Berkeley Complex (the city of Butte and associated developments) would generally fit the same description. Only the area north and west of the tailings pond, and along the Continental Divide (Rampart Mountain) east of the proposed leach dump, have significant wildlife value.

The direct value of these two areas to wildlife is limited by the effects of prior disturbance (roads, ditches, refuse piles) and proximity to human activity. However, the two areas are contiguous with less disturbed, extensive tracks of land that provide sufficient habitat to support wildlife populations.

B. Vegetation

(1) Observations[9/]

The 1976 proposed permit area was traversed January 8 and 14, 1976, which was not the best time of year but did provide an initial point. Plant species visible through the snow were collected and identified using Morris, et al (1962),[20/] Booth (1950)[21/] and Booth and Wright (1966)[22/]. Because of snow cover, only a few of the total number of species in the area were collected. The area was mapped using black and white aerial photography (Figure 3). Three different vegetative communities were identified and mapped as follows:

1. Aspen woodland
2. Shrub-grassland
3. Disturbed

Aspen woodland: This type occurred on moist slopes and swales north of the tailings pond. Quaking aspen (Populus tremuloides) was the most dominant species forming even and uneven-aged stands throughout the type. Where the overstory formed a closed canopy, understory vegetation was limited and probably consisted mainly of Kinikinnick (Arctostphylos uva-ursi) (USFS, 1976, perso. comm.). When the overstory did not form a closed canopy the understory consisted of Russett buffaloberry (Shepherdia canadensis), woods

rose (Rosa woodsii), snowbrush (Ceanothus velutinus), Common juniper (Juniperus communis), currant (Ribes spp.), and numerous forbs and grasses. The areas adjacent to the drainage bottoms also had alder (Alnus tenuifolia), and peachleaf willow (Salix amygdaloides) in the understory and a greater number of willows (Salix spp.) in the understory. An occasional lodgepole pine (Pinus contorta), Douglas fir (Pseudotsuga menziestii), or rocky mountain juniper (Juniperus scopulorum) was found throughout the area.

Parts of this type had previously supported a mature stand of Douglas fir (Pseudotsuga menziesii), as evidenced by a considerable number of decadent stumps. From the condition of the stumps, it is probable that the area was logged in the early mining period. The seral aspen stand has effectively inhibited Douglas fir reinvasion.

Shrub-grassland: This type occurred on the drier portions of the study area north and east of the tailings pond. Dominant shrubs were rubber rabbitbush (Chrysothamnus nauseosus) and, to a lesser extent, big sagebrush (Artemisia tridentata). Other species collected from this type included common juniper (Juniperus communis), currant (Ribes spp.), fringed sage (Artemisia frigida), bluebunch wheatgrass (Agropyron spicatum), needle-and-thread grass (Stipa comata), bluegrass (Poa spp.), needlegrass (Stipa spp.), timothy (Phleum pratense), yarrow (Achillea millefolium), mullein (Verbascum thapsus) and cheatgrass (Bromus tectorum).

Disturbed: The area south and southeast of the Berkeley Pit has been disturbed by past mining or mining associated disturbance and supports virtually no vegetation except for an occasional annual forb. The proposed addition to the original dump area has also been disturbed by residential construction and destruction and vegetation is found only in lawns and vacant lots.

Vegetative Overlay
Permit No. 00030A
Legend:
1 - ASPEN WOODLAND
2 - SHRUB - GRASSLAND
3 - DISTURBED
(See the narrative)
T. 4 N.
R. 8 W.
T. 4
R. 7
T. 3 N.
R. 8 W.
T.
R.
TAILINGS POND
WASTE DUMP
PREPARED LEACH BASE
BERKELEY PIT 8/1/74
Alice Dump
Walkerville
Copperville
GARFIELD
MAPLE
McQueen Detail
(See the Narrative)
UNCONTROLLED REAL ESTATE
JANUARY 1976
Overlay No. 3
Permit Area #00030A
January 1976
PROPOSED NEW PERMIT BOUNDARY
NEW PERMIT AREA = 1477 ACRES
PROPOSED NEW BONDED AREA OF 1477 ACRES
AND AREAS TO BE NEWLY DISTURBED
CITY LIMITS
Butte, Anaconda & Pacific RR
Northern Pacific RR

Adjacent Types: The Deer Lodge National Forest has partially mapped adjacent habitat types (USFS, 1975), appearing as a report by Joy and Cole (1975) adopted from Pfister, et al. (1974). This work has been summarized (DSL, 1975) and lists the Douglas fir/Pinegrass, Douglas fir/Idaho fescue, Douglas fir/twin flower, and Douglas fir/common juniper habitat types as occurring along Interstate 15 between Butte and Elk Park pass, just east of the study area.

(2) Impacts

Much of the vegetation within the proposed permit area would be totally destroyed by the activities as proposed. The Anaconda Co. has indicated that topsoil would not be salvaged prior to disturbance within any part of the proposed permit area.[23/]

(3) Mitigation

The Anaconda Co. has initiated revegetation experiments on their East Continental waste and St. Helena leach dumps. Data and results of these experiments are available for public review in DSL's Helena offices. The following critique of such experiments was prepared by Mr. Dennis Hemmer, a DSL staff member who is conducting reclamation research on areas that have been mined for bentonite.

The Company's experiments are basically good. They are laid out well and test methods appear to be logical. It should be pointed out that the Company's experiments are limited to two isolated sites and therefore results should be applied with discretion. How representative such sites are to the Berkeley and East Continental Complex areas as a whole is still questionable. Specific criticisms of the experiments are as follows.

(a) Seeding rates

Thirty-five lbs/acre is very heavy.

(b) Choice of species

The companys list of shrub of tree species to be included in their experimental plots is quite large.

There seems to be a trend in reclamation experiments to try virtually everything and hope something works. The containerized species listed as available from S.E.A.M. reflects an effort to obtain anything and everything available. In some earlier work on coal mines we obtained the sources of many of these plants. Many were from xeric areas in Utah and Idaho and some species were from the Decker Mine in Eastern Montana. These areas are salty and/or sodic, hardly compatible to the Butte area.

Grease-wood (Sarcobatus vermiculatus) for example is a species found in salty, sodic lowland sites. Engleman spruce is generally found in moist higher elevation sites. Several of the other species are primarily found on basic and/or more sodic soils, and seem out of place on an acidic mine tailings which was originally a forest-grassland.

The Anaconda Co. should begin to collect local seed adapted to the Butte area and then ask S.E.A.M. to grow this for them as containerized stock.

(c) Irrigation

Irrigation is a doubtful practice in reclamation. The question arises; is the company creating a community that needs irrigation to survive? At the two experimental sites, irrigation however may be in some instances be justified to aid in the neutralization of the acid spoils.

Anaconda's reclamation plan as submitted cites experiments as "the revegetation plan." Research is a fine way to discover ways to mitigate impacts, however in their application the company should include a definite plan for revegetation.

VIII. IMPACTS ON HUMAN ENVIRONMENT

A. Employment and Economics

The economic condition of Butte, Montana, remains greatly dependent upon the mining and smelting operation of the Anaconda Company. The international market price of copper has and continues to control the viability of the industry. Other factors including costs of mining equipment, labor, land and water reclamation, smelter operation, power and transportation become significant especially as they rise due to continuing price inflation trends. The copper industry in Montana, like most other industries, has evolved continually away from labor intensive methods and towards increased mechanization.

With the closure of Holy Savior School, two grocery stores and other neighborhood businesses, employment in the McQueen Addition area has been virtually eliminated. Some rental properties are located in this area but the lack of services makes tenants difficult to find. An area surrounded by mining activity has a low market value.

The Anaconda Co. claims that it must pay substantially more than fair market value for the property it acquires and this benefits the area's economy.[9/] The cost of homes in other areas of Butte are substantially higher than in McQueen Addition however and, as a consequence, relocation costs are high.

On September 2, 1976 the Commissioner of State Lands sent a letter to residents of the McQueen Addition which explained about the subject permit and he stated:

> "I am writing to inform you that portions of the application cover the McQueen area of Butte, It was noted that parts of that area not owned or controlled by the Anaconda Company. The A.C.M. has listed your names as being an owner of property within or near the applied for area. The Department has made it clear that it will not grant a permit on those lands not owned or controlled by A.C.M.
>
> An environmental assessment is currently being prepared on the application. However once it is completed, little time will be available to comment since the Department must act by September 29, 1976. If you have any questions or comments, please contact me."

Several residents of the area expressed dissatisfaction with the methods used by the A.C.M. to acquire property. Others stated that they have not been contacted by the company regarding acquisition of their property.

The closing of U.S. Highway 91 is strongly opposed by most McQueen residents who contracted D.S.L. Such residents also felt that the haul truck crossing of the highway near the Weed Concentrator is hazardous despite the presence of a flag man. Many residents complained of the dump at the northeast corner of Yew and Garfield Streets and proceeding north and east. The dump was illegally constructed during July and August, 1976. In constructing the dump several very large rocks (4' X 4' X 4') rolled off the dump and into the adjacent street.

B. Noise

(1) Description of the Environment

Noise levels in the McQueen and East Butte Additions have not been recorded. Noise levels in these areas however are most probably higher than in other residential areas of Butte that are not as surrounded by mining activity.

A noise level of 95 dBA* is produced by a 100-150 ton diesel-electric truck at 50 feet when loaded and at maximum r.p.m. On level or downgrades 80 dBA is typical[16/] a dozer or grader produces 88 dBA at fifty feet.[17/] Doubling the intensity (e.g. 2 trucks in the same area) increases the sound level by 3 dBA. If two haul trucks and a dozer are in operation in the same area, a noise level of 98 dBA at fifty feet would be produced. Natural attenuation is 6 dBA for doubling of distance.

*dBA - decibels A scale. Decibel is a standard measure of sound level based on a logarithmic scale. The A scale is standard sound level scale which is weighted to resemble the human ear's reaction to a sound.

For comparative purposes normal conversation produces 60 dBA at 3 feet; a sound level greater than this interferes with communication. The noise level in an average residence is about 50 dBA, and amount that is approximately the same for a residential neighborhood.

(2) Impacts

All of the homes in the McQueen Addition are within 1900 feet of a recently completed dump. Based on the above analysis residences within 800 feet of the dump are being exposed to increased noise levels. One residence is only 35 feet from the dump.

Sound levels of the magnitude found at the dump do not physically damage buildings however the effects upon man would be noticeable. Such affects include:

(1) psychological - annoyance, disruption of concentration, difficulty in sleeping, etc.

(2) interference with speech communication

(3) Physiological - earaches, headaches.

Factors that influence the psychological effects of noise include the individuals attitude toward the noise source. For example, is exposure voluntary? Is the end result viewed as beneficial? Are others complaining? Have previous encounters with the perpetuator been good or bad?

Mitigation of such noise impacts require modification of mining-related equipment to reduce noise levels and the maintenance of sufficient distance to utilize natural attenuation.

C. Vibrations

Heavy trucks such as those utilized in the Anaconda Co.'s mining operation can initiate vibrations. Depending on the distance involved such vibration is capable of causing objects to fall off walls or causing items to "walk" off

a shelf. Qualities of the transmission medium for such vibrations determines the degree of impact. Loose, unconsolidated material will dampen vibrations and it is therefore not expected that mining equipment traveling on 25 feet or more of broken rock such as that found in the dumps would cause vibration damage.

Blasting in the Berkley Pit is a greater source of vibration. Building damage in the form of broken windows and cracked walls commonly occurs throughout Butte. Limiting the size of a blast reduces the likelihood of damage.

D. Aesthetics

The proposed permit area would increase an already substantial aesthetic impact on the Butte area. Some of the area applied for in the application is already disturbed, in particularly those areas around the Berkeley Pit border and the repair yard, see map following page 1. There are existing mine waste dumps in the southeast corner of the application area. The greatest aesthetic impact will be the building of leach dumps on the present site of the McQueen addition. McQueen has been a residential area for in excess of 75 years. Much of the surface in the McQueen addition is now owned by the Anaconda Co. The company, in anticipation of expanded operations has removed many of the houses.

The leach dumps, if they are successfully revegetated, will be artificial in appearance.

Aesthetic impacts of mining are to some extent colored by the individual viewer's attitude towards such a disturbance.

E. Unique, endangered, fragile or limited environmental resources[9/]

The Montana Hard Rock Law (Title 50, Chapter 12, R.C.M., 1947) does not contain definitions pertainable to this section.

No endangered species of wildlife utilize the area (Jim Cole, Wildlife Biologist, USFS, Butte, personal communication). Since the area has been disturbed to varying degrees, pristine conditions are no longer existent. No unique or limited resources occur within the permit boundaries.

F. Historical and archaeological sites[9/]

Of the three areas considered in the 1976 permit application, only the leach dump site has potential historical value; however, this area is not included in the Butte Historic District. (Montana Department of Fish and Game, Parks and Recreation Division, 1976).

The area to be covered by the dump has not been extensively surveyed for sites of historic significance (Dave Conklin, Montana Fish and Game Dept., personal communication), but no apparent archaeological sites have been identified within the area.

G. Demands on environmental resources of land, water, air and energy[9/]

Land formerly used as an urban unit (the McQueen subdivision) will be lost. Successful reclamation after abandonment of the leach dump could provide land for a variety of uses. If successful reclamation is not accomplished, surface utility of the mined land will have been lost; similar actions will affect land lost to the tailings pond extension.

The proposed permit does not anticipate significant new demands on water, air or energy resources. In fact, fuel consumption will be somewhat decreased.

IX. Individuals contributing to P.E.R.

A. The Anaconda Company

Corbett, Dave
Spindler, John

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APPENDIX A

SOILS

Appendix 2. Soil series descriptions, 1976 Anaconda Company permit application[1]

CARBOL SERIES

The Carbol series is a member of the loamy skeletal, mixed family of Argic Lithic Cryoborolls. These soils have a thin grayish brown A1 horizons, grayish brown gravelly clay loam B2t horizons and very gravelly loamy sand C horizons

Typifying Pedon: Carbol loam

A1	0-315"	Grayish brown (10yr 5/2) gritty loam, very dark brown (10yr 2/2) moist; weak medium platy breaking to weak medium granular structure; soft, friable, very slightly sticky and non plastic; strongly acid (pH 5.0); clear wavy boundary.
B21t	3.5-6"	Grayish brown (10yr 5/2) fine gravelly clay loam, very dark grayish brown (10yr 3/2) moist; moderate medium and fine subangular blocky structure; very hard, very firm, sticky and plastic, thin continuous clay films all ped faces; medium acid (pH 6.0); gradual wavy boundary.
B22t	6-13"	Brown (10yr 5/3) very gravelly sandy clay loam, dark brown (10yr 3/3) crushed, (3/2) coats, moist; moderate medium and fine subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; thin continuous clay films all ped faces; medium acid (pH 6.0); gradual boundary.
IIC	13-18"	Light brownish gray (2.5y 6/2) very gravelly loamy sand, dark grayish brown (2.5y 4/2) moist; single grained and loose.
R	18"+	Granitic bedrock.

[1]Montana Testing Labs., Inc., Helena; for the Anaconda Mining Company, Butte.

Type Location: Silver Bow County, Montana; 100 feet south and 800 feet east of N¼ corner, Section 34, T3N R8W.

Range in Characteristics: The Carbol soils have a mean summer soil temperature less than 59° F and a mean annual soil temperature ranging from 40 to 45° F. The Solum ranges from 8 to 15 inches thick and profile is 10 to 24 inches to a lithic contact. The A1 horizon ranges from 3 to 5 inches thick in colors of 10yr or 7.5yr hue with values of 4 to 5 dry and 2 or 3 moist in chroma of 1 through 3.

The B2t of clay loam or sandy clay loam textures has 26 to 32 percent clay content and color value of 4 or 5 dry and 3 or 4 moist with chroma of 2 or 3 in 10 yr or 7.5 hues. Structure of B2t ranges from weak to moderate prismatic to moderate and strong blocks. Peds in B2t have continuous and patchy clay films. Coarse fragments range from 35 to 50 percent.

C horizon has color value of 5 or 6 dry and 4 or 5 moist with chroma of 2 in hues of 2.5y through 10 yr.

Butte Area 654
10-1-69

LUCKY SERIES

The Lucky series is a member of the coarse loamy, mixed family of Argic Cryoborolls. These soils have a dark grayish brown A1 horizon, gravelly sandy clay loam B2t horizon and a gravelly sandy loam to loamy sand C horizon.

Typifying Pedon: Lucky gritty loam - grassland
(Colors are for dry soil unless otherwise stated).

A11	0-2"	Dark grayish brown (10yr 4/2) gritty loam, very dark brown (10yr 2/2) moist; weak medium platy breaking to moderate fine granular structure; soft, friable, non sticky and non plastic; common fine and very fine roots; very strongly acid (pH 5.0); clear irregular boundary.
A12	2-5"	Dark grayish brown (10yr 4/2) gritty loam, very dark brown (10yr 2/2) moist; moderate medium and coarse platy breaking to moderate fine granular structure; soft, friable, very slightly sticky and slightly plastic; common fine roots; slightly acid (pH 6.2); gradual wavy boundary.
B2t	5-23"	Brown (10yr 5/3) gravelly sandy clay loam, dark brown (10yr 3/3) crushed, (3/2) coats, moist; moderate medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; common fine roots; moderately thick clay films all ped faces; slightly acid (pH 6.2); gradual wavy boundary.
C1	23-30"	Light brownish gray (10yr 6/2) fine gravelly sandy loam, dark grayish brown (10yr 4/2) moist; massive structure; soft, friable, non sticky and non plastic; slightly acid (pH 6.2); gradual wavy boundary.
C2	30-36"	Grayish brown (10yr 5/2) gravelly loamy sand, very dark grayish brown (10yr 3/2) moist; single grained and loose(partially weathered granite bedrock.
R	36" +	Granite bedrock.

Type Location: Silver Bow County, Montana; 600 feet east and 100 feet south of N¼ corner Section 3, T2N R8W.

Range in Characteristics: These soils have a mean summer soil temperature less than 59°F and mean annual soil temperature ranges from 40 to 45 F. The solum ranges from 15 to 26 inches and the profile is 24 to 40 inches to a lithic contact. The A1 horizon ranges from 3 to 6 inches thick in colors of 10 yr or 7.5yr hue with values of 4 or 5 dry and 2 or 3 moist in chromas of 1 or 2. The B2t horizon of clay loam or sandy clay loam textures has 28 to 33 percent clay content and color value of 4 or 5 dry and 3 or 4 moist with chroma of 2 or 3 in 10 yr through 7.5 yr hues. Structure in B2t ranes from moderate medium to coarse angular or subangular blocks. Peds in B2t horizon have moderately thick continuous and patchy clay films. C horizon has color value of 5 or 6 dry and 4 or 5 moist with chroma of 2 in hues of 2.5y through 10yr.

dix 3: Soil type descriptions, 1976 Anaconda Company permit application

Carbol Series

The Carbol soils are most extensive in the uplands adjacent to Butte. They developed in place from granitic rock on rolling to hilly uplands. Elevation ranges from 5,000 to 7,000 feet. Annual precipitation is 12 to 16 inches. These well drained dark colored soils are noncalcareous throughout. They have a thin loam surface layer and clay loam subsoil. The subsoil in underlain by granite bedrock at depths of 10 to 20 inches.

Natural fertility and organic matter content are low. Permeability is moderately rapid and the available water holding capacity is low.

Lucky Series

The Lucky soils are common in most of the upland positions in the Butte area. They developed from granitic materials. Elevation ranges from 5,000 to 7,000 feet. Annual precipitation is 12 to 16 inches.
These well drained dark colored soils are noncalcareous throughout. They have a thin loam surface layer and a clay loam subsoil. The subsoil is underlain by granite bedrock at depths of 20 to 40 inches.

Natural fertility and organic matter content are low. Permeability and available water holding capacity are moderate.

61C. Carbol and Lucky soils, 5 to 9 percent slopes

These soils are on moderately sloping uplands. The shallow Carbol soils make up 50 to 70 percent of the unit. They are on convex positions and slope breaks. The Lucky soils comprise 15 to 25 percent of the init in ares less than 15 acres in size. They occur on smoother slopes in slightly concave positions. Included with this oil is up to 10 percent of soils similar tc Lucky except they are calcareous. They occur in irregular broken patterns in areas less than 5 acres in size. Also included is an occasional Rock Outcrop at slope breaks. Kenspur soils make up 5 to 10 percent of this unit. They are in narrow drainageways and local fans in areas less than 5 acres in size.

These soils are used mainly for grazing and wildlife.

Top soil rating for the Carbol soil is fair with a surface layer less than 6 inches thick.
Top soil rating for the Lucky soil is fair with a surface layer less than 6 inches.
Top soil rating for the Kenspur soil, a minor inclusion, is good with a surface layer ranging from 8 to 24 inches thick.

61E. Carbol and Lucky soils, 9 to 45 percent slopes

These soils are on strongly sloping and steep uplands. They are intermittently stony with gravelly loam or gravelly sandy loam textures. The shallow Carbol soils make up 40 to 60 percent cf the unit. They are on convex positions and steeper slopes. The Lucky soils comprise 20 to 35 percent of the unit in areas less than 20 acres in size. They occur on smoother slopes in slightly concave positions.

luded with this soil is up to 15 percent of soils similar to Lucky except they are calcareous. They are in irregular broken patterns in areas less than 5 acres in size. Also includdd is 10 to 20 percent of Rock outcrop on ridges and slppe breaks. Kenspur soils make up 5 to 10 percent of this unit. They are in narrow drainageways and local fans in areas less than 5 acres in size.

These soils are used mainly for grazing and wildlife.

Topsoil rating for the Carbol and Lucky soils is fair with a surface layer less than 6 inches thick.
Topsoil rating for the Kenspur soil, a minor inclusion, is good with a surface layer ranging from 8 to 24 inches thick.

62F. Rock outcrop - Carbol complex, 35 to 75 percent slopes

This unit consists of a complex of Rock outcrop and Carbol soils with inclusions of Lucky and Kenspur soils. These soils are intermittently stony with gravelly loam or gravelly sandy loam textures. Rock outcrop comprises 40 to 70 percent of the unit. The Carbol soils are on the smoother slopes and make up 20 to 50 p percent of the unit. Kenspur soils are in narrow drainageways and on local fans. They comprise up to 10 percent of the unit in areas less than 5 acres in size. Lucky soils are in small concave positions. They comprise up to 10 percent of the unit in areas less than 5 acres in size.

These soils are used mainly for grazing and wildlife.

Topsoil rating for the Carbol and Lucky soils is fair with a surface layer less than 6 inches thick
Topsoil rating for the Kenspur soil, a minor inclusion, is good with a surface layer ranging from 8 to 24 inches thick.

KENSPUR SERIES

The Kenspur soils are most extensive south and east of Butte and comprise about 3 percent of the area. They developed from granitic material on outwash fans, foot slopes and in swales. Elevation ranges from 5,000 to 6,000 feet. Annual precipitation is 12 to 14 inches.

These are moderately well to well drained dark colored soils. They have a moderately thick loamy surface layer and a stratified subsoil of gravelly loam, sandy loam or coarse loany sand. The subsoil is underlain by loose sand and gravel at depths of 40 to 60 inches.

Natural fertility and organic matter content are high. Permeability and water holding capacity are moderate.

54 E. Kenspur stony loam, 9 to 35 percent slopes

This soil is on strongly sloping and moderately steep local fans and foot slopes of the rolling uplands. It is similar to the gently sloping Kenspur soil except it is stony and the slopes are steeper. Included with this soil are areas less than 5 acres in size of coarse sandy deposits and riverwash. They are on intermittent stream channels and recent alluvial fans. They comprise less than 15 percent of this unit.

This soil is used mainly for grazing and wildlife.

B. Kenspur coarse loamy sand, overwash, 2 to 9 percent slopes

This soil is an overwash phase of the Kenspur soil. It is on gently sloping and moderately sloping local fans and broad drainages below the dissected and eroded uplands. It is similar to the gently sloping Kenspur soils except for the 4 to 12 inch mantle of coarse loamy sand. Included with this soil are areas less than 3 acres in size of Riverwash along intermittent stream channels. They comprise 5 to 10 percent of this unit. Also included is 10 to 15 percent of Basin Creek and typical Kenspur soils. The Basin Creek soils are on slightly convex positions.

This soil is used mainly for grazing and wildlife.

Miscellaneous Land Types

MW Mine Waste

Includes smelter slag, open mine pits, mill tailings and old placer mined areas that have been so severely eroded they support little or no vegetation.

APPENDIX B

WILDLIFE - METHODS AND MATERIALS[1/]

[1/] Montana Testing Labs Inc., Helena, MT for the Anaconda Co.

The Berkeley Complex surveys have been direct observations of wildlife or evidence thereof. Such a survey is relatively fast and inexpensive, and can provide a general indication of the form and degree of wildlife use in an area. However, direct observations do not provide a complete species list for an area (excluding nocturnal species, secretive species, or those species leaving little or no evidence) and supply only a very limited amount of quantified data. In addition, such surveys are greatly hampered by weather conditions that restrict wildlife movement.

Wildlife surveys of the Berkeley Complex were initiated in January, 1976. The January 8 survey was largely conducted by vehicle. The January 14 surveys of the tailings pond and Rampart Mountain areas were on foot, and the McQueen neighborhood by vehicle. Although weather conditions were generally favorable (mild temperature, little wind, clear sky) on both occasions, snow conditions were adverse (approximately three feet at the tailings pond on January 14); results were restricted to a few tracks and droppings for mammals, and actual sightings for birds. In addition, it was barely possible to drive near enough to the area to conduct the survey. For these reasons, the areas were not surveyed in February or March. It is felt that the January results were indicative of winter use, and the February and March use was probably consistent with that of January.

Surveys were scheduled for two different dates in April, but were cancelled due to inclement weather. By the May 6 survey, the snow had melted except for scattered patches in shaded areas at higher elevations. The observation route in the January 14 and May 6 surveys (see map following p. 19) went from the pond edge to considerably higher elevations than the proposed permit area boundary, in an attempt to document wildlife movement and differences in use between the proposed permit area and surrounding lands.

The May 6 survey indicated that most winter big game (elk) use occurred at elevations above the proposed permit area. The survey will continue on a monthly basis to document spring, summer, and autumn use; it is expected that the areas will have greater importance as spring-summer habitat than as wintering areas.

The tailings pond, leach dump, and Highway 91 observation routes were followed on foot (see map following p. 6). The tailings pond route of January 14 was repeated, but expanded to include more area. Strict adherence to the route was not maintained; any interesting feature or microsite seen from the route was investigated more thoroughly. All three community types (aspen, grassland-shrub, disturbed) were examined, although primary effort was concentrated on the aspen and shrub-grassland types.

Observations east of the McQueen leach dump and south of Highway 91 were taken randomly; no effort was made to follow a pre-determined route. Observations in the McQueen neighborhood were made from a moving vehicle.

Quantified data was collected only when direct counts were easily made (for instance, waterfowl in the tailings pond). No effort was made to gather information on population densities, browse utilization, etc. Observations of birds were made through 6 x 35 binoculars, when necessary. Mammals records were derived from tracks, droppings, hair, or actual sightings. Weather (temperature, wind, cloud cover, precipitation) was recorded every hour during the tailings pond survey, and at the end of the total survey.